BIRTH DEFECT RISK FACTOR SERIES: RENAL AGENESIS

DESCRIPTION

Renal agenesis is the absence of one or both of the kidneys. Bilateral renal agenesis is invariably fatal. Unilateral renal agenesis may be asymptomatic and is often incidentally diagnosed by abdominal ultrasound or computed tomography (CT) scan secondary to another condition. In infants with unilateral renal agenesis, the remaining kidney may be enlarged, and there is increased risk of problems with the remaining kidney. Renal agenesis has been associated with such chromosomal abnormalities as trisomy 21, trisomy 22, trisomy 7, trisomy 10, 45,X mosaicism, and 22q11 microdeletion (Bianchi et al., 2000).

Fetal deaths have been reported to account for 10-33% of cases of renal agenesis (Bianchi et al., 2000; Riley et al., 1998; Cunniff et al., 1994). Renal agenesis can be prenatally detected by ultrasound (Bianchi et al., 2000). Thus, in regions where elective termination is allowed, prenatal diagnosis and elective termination may reduce the birth prevalence of renal agenesis (Riley et al., 1998; Sipek et al., 1997; Chi et al., 1995; Papp et al., 1995; Stoll et al., 1995a; Stoll et al., 1995b; Cunniff et al., 1994; Julian-Reynier et al., 1994; Stoll et al., 1992).

The metanephric buds begin to develop into kidneys in the fifth week of gestation. If the metanephric buds fail to develop, renal agenesis results.

DEMOGRAPHIC AND REPRODUCTIVE FACTORS

One investigation reported no significant association between **race/ethnicity** and renal agenesis risk (Leck and Lancashire, 1995). Another study observed no significant difference in risk of renal agenesis/dysgenesis in infants born to Vietnamese women compared to infants born to non-Hispanic white women in California (Shaw et al., 2002). An investigation in Colorado found increased risk of renal agenesis among African-Americans when compared to whites (Parikh et al., 2002). The study did not find any association between renal agenesis and Hispanic ethnicity.

Place of **residence** within a country does not appear to influence risk of renal agenesis (Stroup et al., 1990). One investigation failed to identify any association between renal agenesis and **altitude** (Castilla et al., 1999).

One study reported a **secular trend** for bilateral renal agenesis, with rates for the defect increasing over time (CDC, 1998). However, this increase may have been due to increased ascertainment of other renal anomalies, such as renal dysgenesis. Moreover, other studies reported no secular trends for either bilateral or unilateral renal agenesis (Chi et al., 1995; Stroup et al., 1990; Wilson and Baird, 1985).

One investigation reported **seasonal differences** in renal agenesis rates (Bound et al., 1989), while another study reported no such association (Stroup et al., 1990).

Bilateral renal agenesis risk is affected by **sex**, with the defect being more common among males (Lary and Paulozzi, 2001; Bianchi et al., 2000; Riley et al., 1998; Stoll et al., 1990; Stroup et al., 1990; Wilson and Baird, 1985). Unilateral renal agenesis has been reported to be equally common among the sexes (Wilson and Baird, 1985). One investigation reported a higher proportion of renal agenesis among males (Parikh et al., 2002).

There is no association between renal agenesis risk and either **maternal age** (Bianchi et al., 2000; Hollier et al., 2000) or **paternal age** (McIntosh et al., 1995). However, one investigation reported a higher proportion of renal agenesis with younger maternal age, although the results were not statistically significant (Parikh et al., 2002). Risk of renal agenesis or dysgenesis has been reported to increase with lower **birth weight** (Parikh et al., 2002; Riley et al., 1998; Mili et al., 1991) and **prematurity** (Rasmussen et al., 2001). The renal defect has been associated with **intrauterine growth retardation** (Khoury et al., 1988). Renal agenesis is more common among **multiple gestation pregnancies** (Bianchi et al., 2000; Mastroiacovo et al., 1998; Riley et al., 1998; Kallen, 1986).

FACTORS IN LIFESTYLE OR ENVIRONMENT

Renal agenesis has been associated with lower maternal **education** (Parikh et al., 2002).

Renal agenesis has not been associated with maternal **hyperthyroidism** or **hypothyroidism** (Khoury et al., 1989). The literature on the relationship between renal agenesis and maternal **diabetes** is mixed with several reporting an association (Parikh et al., 2002; Ramos-Arroyo et al., 1992) while others do not (Moore et al., 2000; Becerra et al., 1990). Maternal **hypertension** does not appear to be associated with renal agenesis (Parikh et al., 2002). Cases with renal agenesis are more likely to have lower **maternal weight gain** during pregnancy (Parikh et al., 2002). Another study reported no association between renal agenesis and maternal **obesity** (Moore et al., 2000).

Studies have reported increased risk of renal agenesis or dysgenesis with maternal **alcohol** consumption (Parikh et al., 2002; Moore et al., 1997). Several studies found increased risk of renal agenesis with maternal **smoking**, although the increase was not statistically significant (Parikh et al., 2002; Honein et al., 2001; Kallen, 1997; Shiono et al., 1986). Other investigations found no association between maternal use of **cephalosporin antibiotics**, **ampicillin**, or the **benzodiazepines** nitrazepam, medazepam, tofisopam, alprazolum, and clonazepam during pregnancy and renal agenesis (Eros et al., 2002; Czeizel et al., 2001a; Czeizel et al., 2001b).

Maternal use of **folic acid** at any time during pregnancy does not appear to affect risk of renal agenesis (Czeizel et al., 1996).

PREVALENCE

The reported prevalence for renal agenesis has shown variation between studies, ranging between 0.4 and 3.9 per 10,000 births for bilateral renal agenesis and 0.4 and 4.9 for unilateral renal agenesis (Table 1). Differences in prevalence may be due to differences in case inclusion criteria.

Table 1. Prevalence per 10,000 births of renal agenesis

Reference	Location	Time period	Bil rate	Uni rate	Bil & uni rate	Unk rate
Parikh et al., 2002	Colorado, USA	1989-1998			3.4	
Sekhobo and Druschel, 2002	New York, USA	1996				3.0*
Riley et al., 1998	Australia	1983-1995			5.0*	
Torfs and Christianson, 1998	California, USA	1983-1993	0.6	0.8		
Sipek et al., 1997	Czech Republic	1961-1995				2.0
Chi et al., 1995	Great Britain	1980-1991	3.9*	2.1*	5.9*	
Papp et al., 1995	Hungary	1988-1990	1.6			
Stoll et al., 1995a	France	1985-1992	2.1	4.9	7.1	
Stoll et al., 1995b	France	1979-1992				5.5
Stoll and EUROCAT Working Group, 1995	Europe	1980-1990				3.5
Cunniff et al., 1994	Arkansas, USA	1985-1990	1.3	0.4	1.7	
Julian-Reynier et al., 1994	France	1984-1990	0.9	1.0	1.9	
Castilla and Lopez-Camelo, 1990	Central and South America	1982-1986				0.7
Stoll et al., 1990	France	1979-1986	2.4	3.1	5.5	
Stroup et al., 1990	USA	1970-1982	0.4	0.2	0.5	
Bound et al., 1989	Great Britain	1957-1981	2.7	3.2		
Bankier et al., 1985	Australia	1975-1980	1.6			

Reference	Location	Time period	Bil rate	Uni rate	Bil & uni rate	Unk rate
Wilson and Baird, 1985	Canada	1952-1982	1.2	1.5	2.7	
Czeizel and Vitez, 1981	Hungary	1970-1977				3.6

Bil - bilateral, Uni - unilateral, Unk - unknown laterality
*agenesis and dysplasia

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